



## History and Distribution of the Cultivated Cucurbits in the Americas

Hugh C. Cutler; Thomas W. Whitaker

*American Antiquity*, Vol. 26, No. 4 (Apr., 1961), 469-485.

Stable URL:

<http://links.jstor.org/sici?sici=0002-7316%28196104%2926%3A4%3C469%3AHADOTC%3E2.0.CO%3B2-U>

*American Antiquity* is currently published by Society for American Archaeology.

---

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/about/terms.html>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/journals/sam.html>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

---

For more information on JSTOR contact [jstor-info@umich.edu](mailto:jstor-info@umich.edu).

©2003 JSTOR

<http://www.jstor.org/>  
Tue Nov 25 19:52:15 2003

# AMERICAN ANTIQUITY

VOLUME 26

APRIL 1961

NUMBER 4

## HISTORY AND DISTRIBUTION OF THE CULTIVATED CUCURBITS IN THE AMERICAS

HUGH C. CUTLER AND THOMAS W. WHITAKER

### ABSTRACT

All species of *Cucurbita* (which includes squashes, pumpkins, and the common, small, yellow-flowered gourds) are native to the Americas. Their center of origin lies in Mexico where most of the 26 wild and cultivated species still grow. Chilicayote (*C. ficifolia*), a perennial and probably the oldest cultivated species, is grown from Mexico to Bolivia and known archaeologically only from coastal Peru (3000 B.C.). Oldest archaeological cucurbits are *C. pepo* and *Lagenaria siceraria*, the bottle gourd. Specimens of these species were recovered from Tamaulipas in cave material dated 7000-5500 B.C. *Pepo* and *Lagenaria* spread over most of the United States probably with the advent of agriculture. *Cucurbita moschata* appeared in coastal Peru at the same time as *C. ficifolia* (3000 B.C.), but it does not occur in the Ocampo Cave cultures until 1400-400 B.C. when pottery and village life entered, and corn, cotton, pepo, and beans (common, lima and jack) were being grown. While the earliest dates for *moschata* in southwestern United States are about A.D. 1100, it probably entered the same time as cotton, perhaps as early as A.D. 700. *Cucurbita mixta*, the cushaw, is the most recent of the cultivated species. It is found mainly in Mexico and in post-A.D. 1000 sites in the southwestern U.S. Prehistoric *C. maxima* is known only from Peru and to the south and east in Chile and Bolivia. Its ancestors probably were carried there by man from the Mexican center, and the weedy *C. andreana* may have been taken along at the same time.

The bottle gourd is most variable in the Old World. It probably originated there, and was carried to the New World in pre-agricultural times by ocean currents. A number of other cucurbits and the tree gourd, *Crescentia cujete*, not a true gourd but a member of the family Bignoniaceae, are briefly mentioned. Parts useful in identifying the cultivated cucurbits are the fruit stem or peduncle, seeds, rind, and leaves. A list of the collections of *Cucurbita* and *Lagenaria* which have been studied is given, with estimates for the date of each site.

THERE is a vast amount of evidence to indicate that species of two genera in the Cucurbitaceae, namely *Cucurbita* (pumpkins and squashes) and *Lagenaria* (gourds) had an important role in pre-Columbian agriculture. This evidence in the form of seeds, rinds, and peduncles has been excavated from a great many arch-

aeological sites in the Western Hemisphere. The material, most of it well documented, has accumulated in museums in this country and Latin America. It has never been thoroughly studied with the purpose of determining the pattern of distribution of the species involved in time and area, their importance in the economy of the native peoples, and their association with other crop plants. It is the aim of this report to record the facts we have gathered in a systematic attempt to answer these questions.

Squashes and gourds may have been the earliest domesticated plants of the New World. They are found with beans at levels which are older and lie below those in which corn is found at two sites: Huaca Prieta on the north coast of Peru (Whitaker and Bird 1949) and the Ocampo Caves of Tamaulipas, Mexico (Whitaker, Cutler, and MacNeish 1957). Squashes and gourds of coastal Peru are dated before 3000 B.C. while in the Ocampo Caves some specimens were found in the Infiernillo culture deposits tentatively dated 7000-5500 B.C. It is likely that these very early Mexican specimens represent wild, weedy plants or camp-followers, for there is little evidence of agriculture at that time.

### PUMPKIN, SQUASH, AND GOURD

The terms pumpkin and squash are of no value in distinguishing species of *Cucurbita*. The common New England pumpkin, White Bush Scallop squash, Italian or Zucchini squash, Summer Crookneck squash, and Acorn squash, for example, are all cultivars of the same species, *C. pepo* L., while Kentucky Field Pumpkin and Butternut squash are cultivars of *C. moschata* Poir. As a rule pumpkins are coarse and strongly flavored fruits of any species of *Cucurbita* utilized when ripe as forage, as a table vegetable, or in pies. Squashes are finer textured, milder flavored cultivars used immature or when mature, baked, boiled, or in pies, less commonly used as

feed for livestock. To facilitate discussion we use the specific name as the common name.

The word gourd usually refers to the bottle gourd, *Lagenaria siceraria* (Mol.) Standl., and when other gourds are mentioned here they are described, for example, the small pepo gourd (*Cucurbita pepo* var. *ovifera* Alef.), or the buffalo gourd (*C. foetidissima* HBK.). Several tropical trees bear fruits which are often used for containers or musical instruments and are called gourds. Most common is *Crescentia cujete* L., usually called the calabash tree or gourd tree. It is, however, a member of the Bignoniaceae, the family to which the catalpa and trumpet creeper belong. These tropical tree fruits should be called tree gourds to distinguish them from the true gourds of the gourd family, Cucurbitaceae.

#### DISTRIBUTION

In pre-Columbian times the cucurbits were more important than any other group of cultivated plants in the New World except corn. As would be expected, their importance varied with different cultures and in different areas. Apparently they were unknown to some cultures in locations where they could have been grown successfully, while in a few other areas, because of the limitations of soil, climate, and other factors, the plants could not be grown.

The center of distribution of the 26 species of the genus *Cucurbita* is in central and northern Mexico (see Table 1). Only the cultivated species *C. maxima* Duch., *C. moschata*, *C. ficifolia* Bouché, the weedy *C. andreana* Naud., and the wild *C. lundelliana* Bailey, have spread southward beyond Mexico. As the genus moved northward into the dry plateaus and deserts of northern Mexico and the southwestern United States, many xerophytic species evolved, some with peculiar adaptations that have fitted them for survival in these rugged habitats. All species of *Cucurbita* are strictly New World plants. Not a single specimen, report, or illustration dated prior to 1492 has ever been found in the Old World. There is ample evidence from the distribution of the wild species and the abundant remains in archaeological sites that the squashes, pumpkins, and their wild relatives have had a long history of association with man in the New World (Table 2).

#### USES OF THE *Cucurbita*

There are reliable reports and collections which show that the seeds and fruits of several

of the wild squashes have been used for food. The fruits of all of the wild species, listed in Table 1, are somewhat similar so it is likely that most of them were used for food. The wild species with the widest distribution and the one most frequently seen in collections from living Indians or from archaeological sites is *Cucurbita foetidissima*, the buffalo gourd, coyote melon, or calabazilla (Fig. 1). All parts of this plant usually are so bitter and obnoxious to taste and smell that some form of treatment is required

TABLE 1. NON-CULTIVATED SPECIES OF *Cucurbita*\*

Species	Present Distribution
Species which are mainly annual and grow in moist areas	
<i>C. texana</i> Gray	Central and southern Texas
<i>C. sororia</i> Bailey	Southern Mexico
<i>C. fraterna</i> Bailey	Northeastern Mexico
<i>C. radicans</i> Naud.	About Mexico City
<i>C. okeechobeensis</i> Bailey	Lake Okeechobee, Florida
<i>C. martinezii</i> Bailey	State of Veracruz, Mexico
<i>C. pedatifolia</i> Bailey	State of Querétaro, Mexico
<i>C. lundelliana</i> Bailey	British Honduras; Department of Petén, Guatemala; Southeastern Mexico
<i>C. palmeri</i> Bailey	Northwestern Mexico
<i>C. gracilior</i> Bailey	Southern Mexico
<i>C. andreana</i> Naud.	Uruguay, Argentina, Bolivia
<i>C. kellyana</i> Bailey	State of Jalisco, Mexico
<i>C. moorei</i> Bailey	State of Hidalgo, Mexico
Species which are mainly perennial and grow in dry areas	
<i>C. foetidissima</i> HBK.	Central Mexico to California, Arizona, Nevada, Utah, eastward to Nebraska and Missouri
<i>C. cordata</i> Wats.	Baja California, Mexico
<i>C. cylindrata</i> Bailey	Baja California, Mexico
<i>C. digitata</i> Gray	Southern New Mexico, Arizona and California, and Sonora, Mexico
<i>C. palmata</i> Wats.	Southwestern Arizona, southern California and adjacent Baja California
<i>C. californica</i> Torr. ex Wats.	Southwestern Arizona, southern California and adjacent Baja California
<i>C. galeottii</i> Cogn.	State of Oaxaca, Mexico
<i>C. scabridifolia</i> Bailey	Southern Tamaulipas, Mexico

\* Bailey 1943, 1948.

TABLE 2. A SELECTED LIST OF CUCURBIT MATERIAL FROM ARCHAEOLOGICAL SITES IN THE AMERICAS.  
LISTED CHRONOLOGICALLY FOR EACH SPECIES

Site	Approximate Date	PLANT PARTS IDENTIFIED		
		Peduncle	Seeds	Rind
Wild Cucurbita				
Ocampo Caves, Tamaulipas, Mexico.....	7000 B.C.-A.D. 1750		x	x
Cordova Cave, New Mexico.....	300 B.C.-A.D. 1200	x	x	x
Tularosa Cave, New Mexico.....	300 B.C.-A.D. 1200	x	x	x
O-Block Cave, Reserve, New Mexico.....	? B.C.-A.D. 1150		x	x
Pueblo II Rockshelters, Clark County, New Mexico.....	A.D. 900-1050		x	x
Gourd Cave, near Betatakin, Arizona.....	?			x
Glen Canyon (numerous sites), Arizona and Utah.....	A.D. 1050-1250	x	x	x
Montezuma Castle, Arizona.....	A.D. 1100-1150	x	x	x
Hinkle Park, Reserve, New Mexico.....	A.D. 1100-1200			x
Kiet Siel, Arizona.....	A.D. 1100-1284			x
Higgins Flat, Reserve, New Mexico.....	A.D. 1175-1250		x	x
Rock Shelter, Lincoln County, New Mexico.....	A.D. 1200-1300			x
Roaring River State Park, Missouri.....	A.D. 1200-1500		x	
Awatovi, Arizona.....	A.D. 1213-1700		x	x
Arizona W:10:50, Point of Pines, Arizona.....	A.D. 1250	x	x	x
Cosper Cliff Cave, Reserve, New Mexico.....	A.D. 1275-1300			x
Arizona W:9:72, Red Bow Cliff Dwelling, Point of Pines, Arizona.....	A.D. 1275-1400			x
Gila Pueblo, Arizona.....	A.D. 1345-1385			x
Tonto Upper Ruin, Arizona.....	A.D. 1346	x		x
Fort Randall Reservoir, South Dakota.....	A.D. 1700		x	
Walapai, Arizona.....	A.D. 1900		x	x
Cucurbita pepo				
Ocampo Caves, Tamaulipas, Mexico.....	7000 B.C.-A.D. 1750	x	x	x
Cordova Cave, New Mexico.....	300 B.C.-A.D. 1200	x	x	
Tularosa Cave, New Mexico.....	300 B.C.-A.D. 1200	x	x	
O-Block Cave, Reserve, New Mexico.....	? B.C.-A.D. 1150	x	x	x
Falls Creek, Colorado.....	A.D. 174-945		x	
Mummy Cave, Canyon del Muerto, Arizona.....	A.D. 380-1284	x	x	
Smith Creek Cave, White Pine County, New Mexico.....	A.D. 600- ?		x	
Antelope Cave, Northern Arizona.....	A.D. 700-900		x	
Yampa Canyon Caves, Yampa Canyon, Colorado.....	A.D. 690-1000	x	x	x
Cave Valley, Chihuahua, Mexico.....	A.D. 900-1000	x	x	
Pueblo II Rockshelters, Clark County, New Mexico.....	A.D. 900-1050		x	
Chetro Ketl, Chaco Canyon, New Mexico.....	A.D. 911-1116		x	x
Walnut Canyon, Arizona.....	A.D. 911-1256		x	
Bone Awl House, Mesa Verde, Colorado.....	A.D. 958-1187	x		x
Gourd Cave, near Betatakin, Arizona.....	?		x	
Glen Canyon (numerous sites), Arizona and Utah.....	A.D. 1050-1250	x	x	x
Canyon de Chelly, Arizona.....	A.D. 1058-1275		x	
Square Tower House, Mesa Verde, Colorado.....	A.D. 1066-1246	x		x
Room 25, Wupatki National Monument, Arizona.....	A.D. 1070-1205		x	
Montezuma Castle, Arizona.....	A.D. 1100-1150	x		
Aztec Ruins National Monument, New Mexico.....	A.D. 1110-1125			x
Hinkle Park, Reserve, New Mexico.....	A.D. 1100-1200	x	x	
Kiet Siel, Arizona.....	A.D. 1100-1284	x		
Various sites in Missouri, Illinois, Iowa, South Dakota, Kansas, and Oklahoma.....	A.D. 1100-1800	x	x	
Higgins Flat, Reserve, New Mexico.....	A.D. 1175-1250		x	
Kin Kletso, Chaco Canyon, New Mexico.....	A.D. 1179	x		x
Roaring River State Park, Missouri.....	A.D. 1200-1500		x	x
Durango, Mexico.....	A.D. 1200-1900	x		
Awatovi, Arizona.....	A.D. 1213-1700	x	x	
Betatakin Ruin, Arizona.....	A.D. 1242-1276	x		x
Arizona W:10:50, Point of Pines, Arizona.....	A.D. 1250	x		
Tower Unit, Mummy Cave, Canyon de Chelly, Arizona.....	A.D. 1251-1284	x		
Kokopnyama, Jeddito Valley, Arizona.....	A.D. 1254-1495		x	
Cosper Cliff Cave, Reserve, New Mexico.....	A.D. 1275-1300	x	x	

TABLE 2. A SELECTED LIST OF CUCURBIT MATERIAL FROM ARCHAEOLOGICAL SITES IN THE AMERICAS.  
LISTED CHRONOLOGICALLY FOR EACH SPECIES (CONTINUED):

Site	Approximate Date	PLANT PARTS IDENTIFIED		
		Peduncle	Seeds	Rind
Arizona W:9:72, Red Bow Cliff Dwelling, Point of Pines, Arizona.....	A.D. 1275-1400	x	x	
Sunny Glen, Cave 2, Chisos Mountains, Texas.....	A.D. 1300 ?		x	
Canyon Creek Ruin, Arizona.....	A.D. 1323-1347	x		
Jemez Cave, New Mexico.....	A.D. 1325-1657	x	x	x
Gila Pueblo, Arizona.....	A.D. 1345-1385	x		
Tonto Upper Ruin, Arizona.....	A.D. 1346	x		
Walker-Gilmore Site, Nebraska.....	A.D. 1400-1500		x	x
Whitehall, Michigan Lower Peninsula.....	A.D. 1500		x	
Sheep Rock Shelter, Huntingdon County, Pennsylvania.....	A.D. 1570	x	x	x
Oahe Reservoir, South Dakota.....	A.D. 1700-1750		x	
Phillips Ranch, South Dakota.....	A.D. 1700-1800		x	
Garrison Reservoir, North Dakota.....	A.D. 1825-1837		x	
Walapai, Arizona.....	A.D. 1900	x	x	
San Ildefonso Pueblo, New Mexico.....	modern		x	
Tesuque Pueblo, New Mexico.....	modern	x	x	x
Taos Pueblo, New Mexico.....	modern	x	x	x
Omaha Indians, Nebraska.....	modern		x	
Arikara Indians, North Dakota.....	modern		x	
<i>Cucurbita moschata</i>				
Huaca Prieta, Chicama, Peru.....	3000-1000 B.C.	x	x	x
Ocampo Caves, Tamaulipas, Mexico.....	1850 B.C.-A.D. 1750	x	x	x
Uaxactún, Department of Petén, Guatemala.....	A.D. 900	x		
Pueblo II Rockshelters, Clark County, New Mexico.....	A.D. 900-1050	x		
Montezuma Castle, Arizona.....	A.D. 1100-1150	x	x	x
Kiet Siel, Arizona.....	A.D. 1100-1284		x	
Arizona W:10:50, Point of Pines, Arizona.....	A.D. 1250	x	x	
Cosper Cliff Cave, Reserve, New Mexico.....	A.D. 1275-1300	x		
Arizona W:9:72, Red Bow Cliff Dwelling, Point of Pines, Arizona.....	A.D. 1275-1400	x	x	
Chincha, Peru.....	A.D. 1300-1530		x	
Canyon Creek Ruin, Arizona.....	A.D. 1323-1347	x		
Tonto Upper Ruin, Arizona.....	A.D. 1346	x	x	x
Oahe Reservoir, South Dakota.....	A.D. 1700-1750		x	
Garrison Reservoir, North Dakota.....	A.D. 1825-1837		x	
Omaha Indians, Nebraska.....	modern		x	
Arikara Indians, North Dakota.....	modern		x	
Pawnee Indians, Oklahoma.....	modern		x	
<i>Cucurbita mixta</i>				
Ocampo Caves, Tamaulipas, Mexico.....	A.D. 150-1050	x	x	
Ventana Cave, Arizona.....	? -A.D. 900		x	
Cave Valley, Chihuahua, Mexico.....	A.D. 900-1000	x		
Pueblo II Rockshelters, Clark County, New Mexico.....	A.D. 900-1050		x	x
O-Block Cave, Reserve, New Mexico.....	A.D. 900-1000		x	
Walnut Canyon, Arizona.....	A.D. 911-1256			x
Gourd Cave, near Betatakin, Arizona.....	?		x	
Glen Canyon (numerous sites), Arizona and Utah.....	A.D. 1050-1250	x	x	x
Room 25, Wupatki National Monument, Arizona.....	A.D. 1070-1205		x	
Montezuma Castle, Arizona.....	A.D. 1100-1150	x	x	x
Hinkle Park, Reserve, New Mexico.....	A.D. 1100-1200		x	x
Higgins Flat, Reserve, New Mexico.....	A.D. 1175-1250		x	
Rock Shelter, Lincoln County, New Mexico.....	A.D. 1200-1300	x	x	
Awatovi, Arizona.....	A.D. 1213-1700	x	x	
Betatakin Ruin, Arizona.....	A.D. 1242-1276	x		
Arizona W:10:50, Point of Pines, Arizona.....	A.D. 1250	x	x	x

TABLE 2. A SELECTED LIST OF CUCURBIT MATERIAL FROM ARCHAEOLOGICAL SITES IN THE AMERICAS.  
LISTED CHRONOLOGICALLY FOR EACH SPECIES (CONTINUED):

Site	Approximate Date	PLANT PARTS IDENTIFIED		
		Peduncle	Seeds	Rind
Tower Unit, Mummy Cave, Canyon de Chelly, Arizona.....	A.D. 1251-1284	x		x
Cosper Cliff Cave, Reserve, New Mexico.....	A.D. 1275-1300	x	x	
Arizona W:9:72, Red Bow Cliff Dwelling, Point of Pines, Arizona.....	A.D. 1275-1400	x	x	x
Canyon Creek Ruin, Arizona.....	A.D. 1323-1347	x		
Tonto Upper Ruin, Arizona.....	A.D. 1346	x	x	x
Walapai, Arizona.....	A.D. 1900	x	x	
San Ildefonso Pueblo, New Mexico.....	modern		x	
Tesuque Pueblo, New Mexico.....	modern		x	
Taos Pueblo, New Mexico.....	modern	x	x	x
Pawnee, Oklahoma.....	modern		x	
<i>Cucurbita maxima</i>				
Ica Valley, Ocucaje, Peru.....	A.D. 600		x	
San Nicolas, near Supe, Peru.....	A.D. 1200		x	
Ica Valley, Chulpaca, Site M, Peru.....	A.D. 1300-1400		x	
Taos Pueblo, New Mexico.....	modern	x	x	x
Omaha Indians, Nebraska.....	modern		x	
Arikara Indians, North Dakota.....	modern		x	
Pawnee Indians, Oklahoma.....	modern		x	
<i>Lagenaria siceraria</i>				
Ocampo Caves, Tamaulipas, Mexico.....	7000 B.C.-A.D. 1750	x	x	x
Huaca Prieta, Chicama, Peru.....	3000-1000 B.C.	x	x	x
Cordova Cave, New Mexico.....	300 B.C.-A.D. 1200	x		x
Tularosa Cave, New Mexico.....	300 B.C.-A.D. 1200	x		x
O-Block Cave, Reserve, New Mexico.....	A.D. 150-500			x
Mummy Cave, Canyon del Muerto, Arizona.....	A.D. 380-1284			x
Vandal Cave, Arizona.....	A.D. 608-683			x
Step House, Mesa Verde, Colorado.....	A.D. 610			x
Antelope Cave, Northern Arizona.....	A.D. 700-900			x
Cave Valley, Chihuahua, Mexico.....	A.D. 900-1000			x
Pueblo II Rockshelters, Clark County, New Mexico.....	A.D. 900-1050	x		x
Chetro Ketl, Chaco Canyon, New Mexico.....	A.D. 911-1116			x
Walnut Canyon, Arizona.....	A.D. 911-1256			x
Bone Awl House, Mesa Verde, Colorado.....	A.D. 958-1187			x
Gourd Cave, near Betatakin, Arizona.....	?			x
Glen Canyon (numerous sites), Arizona and Utah.....	A.D. 1050-1250	x	x	x
Square Tower House, Mesa Verde, Colorado.....	A.D. 1066-1246			x
Montezuma Castle, Arizona.....	A.D. 1100-1150			x
Aztec Ruins National Monument, New Mexico.....	A.D. 1110-1125			x
Hinkle Park, Reserve, New Mexico.....	A.D. 1100-1200			x
Various sites in Missouri, Illinois, Iowa, South Dakota, Kansas, and Oklahoma.....	A.D. 1100-1800			x
Higgins Flat, Reserve, New Mexico.....	A.D. 1175-1250		x	
Roaring River State Park, Missouri.....	A.D. 1200-1500			x
Durango, Mexico.....	A.D. 1200-1900			x
Beratakin Ruin, Arizona.....	A.D. 1242-1276			x
Arizona W:10:50, Point of Pines, Arizona.....	A.D. 1250	x	x	x
Cosper Cliff Cave, Reserve, New Mexico.....	A.D. 1275-1300	x	x	
Canyon Creek Ruin, Arizona.....	A.D. 1323-1347		x	x
Jemez Cave, New Mexico.....	A.D. 1325-1657			x
Tonto Upper Ruin, Arizona.....	A.D. 1346			x
Sheep Rock Shelter, Huntingdon County, Pennsylvania.....	A.D. 1570	x	x	x
Walapai, Arizona.....	A.D. 1900			x

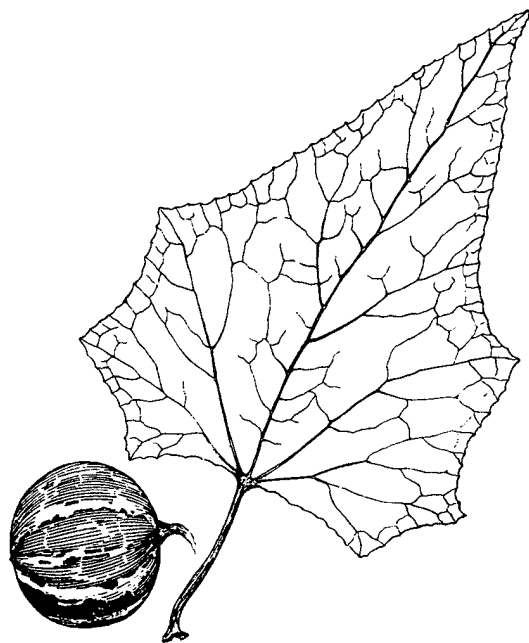


FIG. 1. Leaf and fruit of *Cucurbita foetidissima*, x ¼.

before they can be eaten. The seeds were gathered by many Indian groups and roasted or boiled; the young fruits are reported to have been boiled repeatedly, often with some ashes, before being consumed; and the pulp of the fruits was used as a detergent for cleaning and scouring. Pieces of the large starchy roots of wild *Cucurbita* found in Tularosa Cave suggest the roots were also used for food. The roots of another cucurbit, the native, cultivated chayote, *Sechium edule* Sw., are used for food today in Mexico and Guatemala. Notes by Edmund Nequawwa, a Hopi Indian, on two herbarium sheets of *foetidissima* flowers in the Museum of Northern Arizona say, "Used as food. Cornmeal cake dropped inside blossom and baked."

Practically all wild gourds are native to the Southwest, Mexico, and northern Central America. The only exceptions are *Cucurbita okeechobeensis* Bailey, collected several times on the east shore of Lake Okeechobee, Florida, where it grows over bushes and trees, and *C. andreana*, a weed of Argentina and Bolivia, probably brought in by man with the cultivated *C. maxima*. Several of the squashes cultivated in Bolivia and Argentina appear to be hybrids of *andreana* and *maxima* and similar forms have resulted from crosses made by Whitaker in California (unpublished data).

The primary use of the cultivated *Cucurbita* by the native American peoples was for food. There are a few records of the use of the boiled or fried flowers for food by modern Indians. Many records of the use of young fruits, and the frequency of immature fruit stems (peduncles) suggest that the use of green fruits is an ancient one. Mature fruits were eaten when harvested or were stored. Travelers among the Indians of South, Central, and North America describe the storage of entire fruits as well as dried or cooked strips or rings of flesh.

A far less important use of cultivated *Cucurbita* was for containers, ornaments, rattles, and musical instruments. The bottle gourd *Lagenaria siceraria*, is the most common container, but the fruits of hard-shelled, edible *Cucurbita* (the squashes and pumpkins), ornamental yellow-flowered gourds, a botanical variety of *C. pepo*, and the fruits of some wild species of *Cucurbita* have often been used for this purpose.

#### PLANT PARTS NEEDED FOR IDENTIFICATION OF ARCHAEOLOGICAL SPECIMENS

The quality and quantity of the archaeological specimens of cucurbits varies tremendously with the type of site from which the materials have been excavated. Plant parts of cucurbits are preserved only in comparatively dry sites. Characteristically, open sites yield only carbonized materials which are not nearly as satisfactory for identification as uncharred material.

The best preserved materials in North America come from the Great Plains area, the Southwestern United States, and contiguous areas in Northern Mexico. East of the Mississippi River and along the Gulf Coast of United States increased precipitation and few dry caves have severely limited the preservation of plant parts of these species. Presumably for the same reasons, there are few cucurbitaceous specimens from Central America. Along the coast of Peru, archaeologists have excavated a number of sites from which specimens of *Cucurbita* and *Lagenaria* were recovered in significant quantities.

The *peduncles* are frequently preserved intact and even when charred, broken or eroded they can be identified with a great deal of precision. Taken by themselves, they are the single, most useful tool available for identifying archaeological specimens of *Cucurbita* and *Lagenaria* at the species level (Fig. 2).

The *seeds* can be used to identify species, if mature, and not seriously damaged by abrasion, shrinking, and decay. Carbonized seeds can also

be used for purposes of identification, if handled with reasonable care. When exposed to temperatures high enough to heat or char them, the seeds swell or puff but remain intact, and their relative dimensions are the same. A wide range of experience and expert judgment is required to identify seeds. A good collection of seeds of modern varieties is helpful for comparison and for checking determinations. However, seed morphology is distinctive enough for most specimens to separate them into species with considerable accuracy (Figs. 3, 4). The distinctive characteristics of the peduncles and seeds of the cultivated *Cucurbita* are itemized in Table 3.

The rinds are helpful for purposes of identification, but with limitations. Those of *Lagenaria* can be told from *Cucurbita*, but at present we have no macroscopic or microscopic techniques that will distinguish between the different species of *Cucurbita*. There are one or two, perhaps more, exceptions to this general statement. An occasional neck fragment of *C. mixta* can be identified by the longitudinal lines of corky outgrowth on the surface of the rind. The thin paper-like, and frequently twisted rind fragments of *C. foetidissima* are characteristic for this species. Cultivars of *C. pepo* with roughened or warted skin can be identified from rind

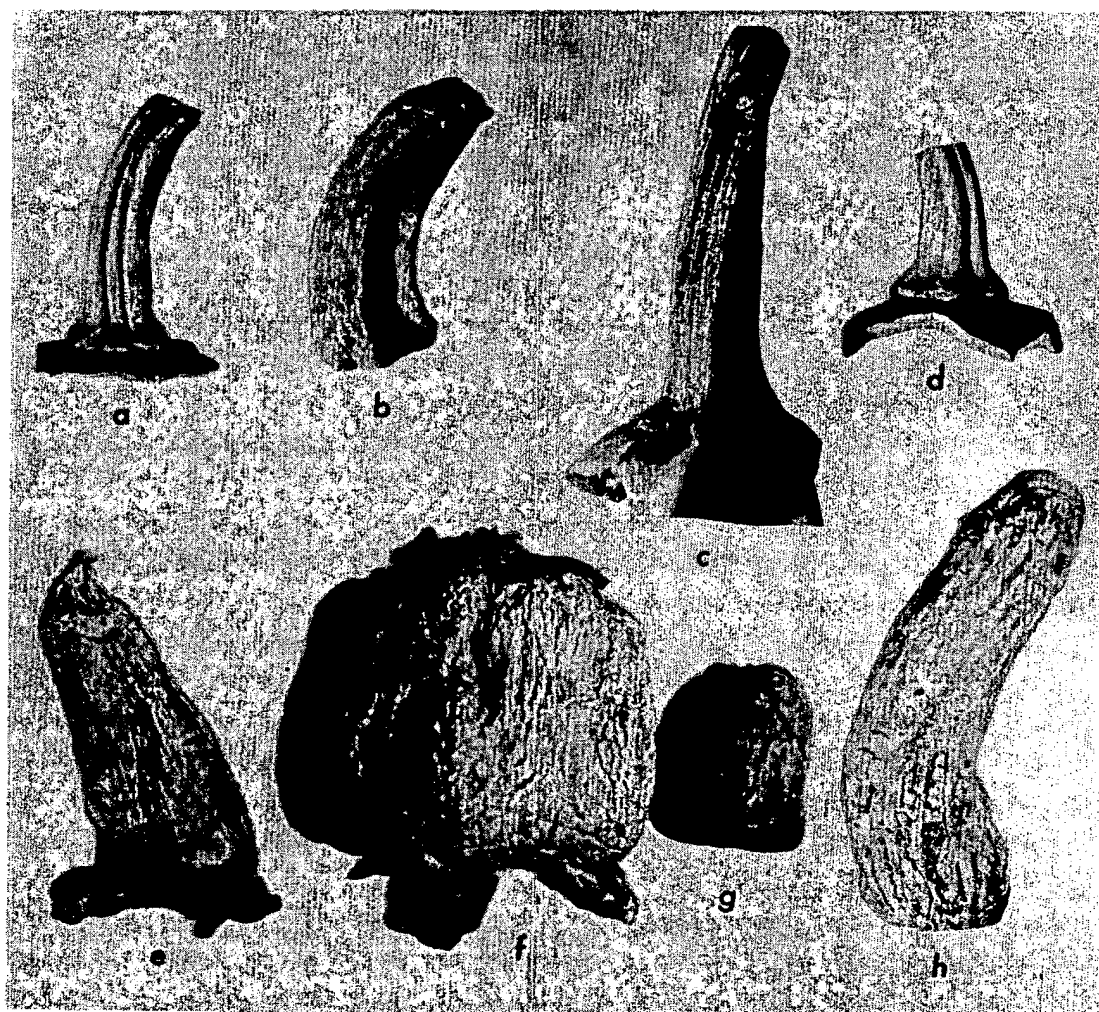


FIG. 2. Peduncles or fruit stems of various cucurbits,  $\times \frac{1}{2}$ . a, *Cucurbita ficifolia*; b, *C. pepo* from a Pueblo III site in Glen Canyon, Utah; c, *C. pepo* cultivar Early Field Pumpkin; d, *C. moschata* from Guatemala; e, *C. mixta* cv. Green Striped Cushaw; f, *C. mixta* cv. Japanese Pie; g, *C. mixta* from a Pueblo III site in Glen Canyon, Utah; h, *C. maxima* cv. Hubbard.



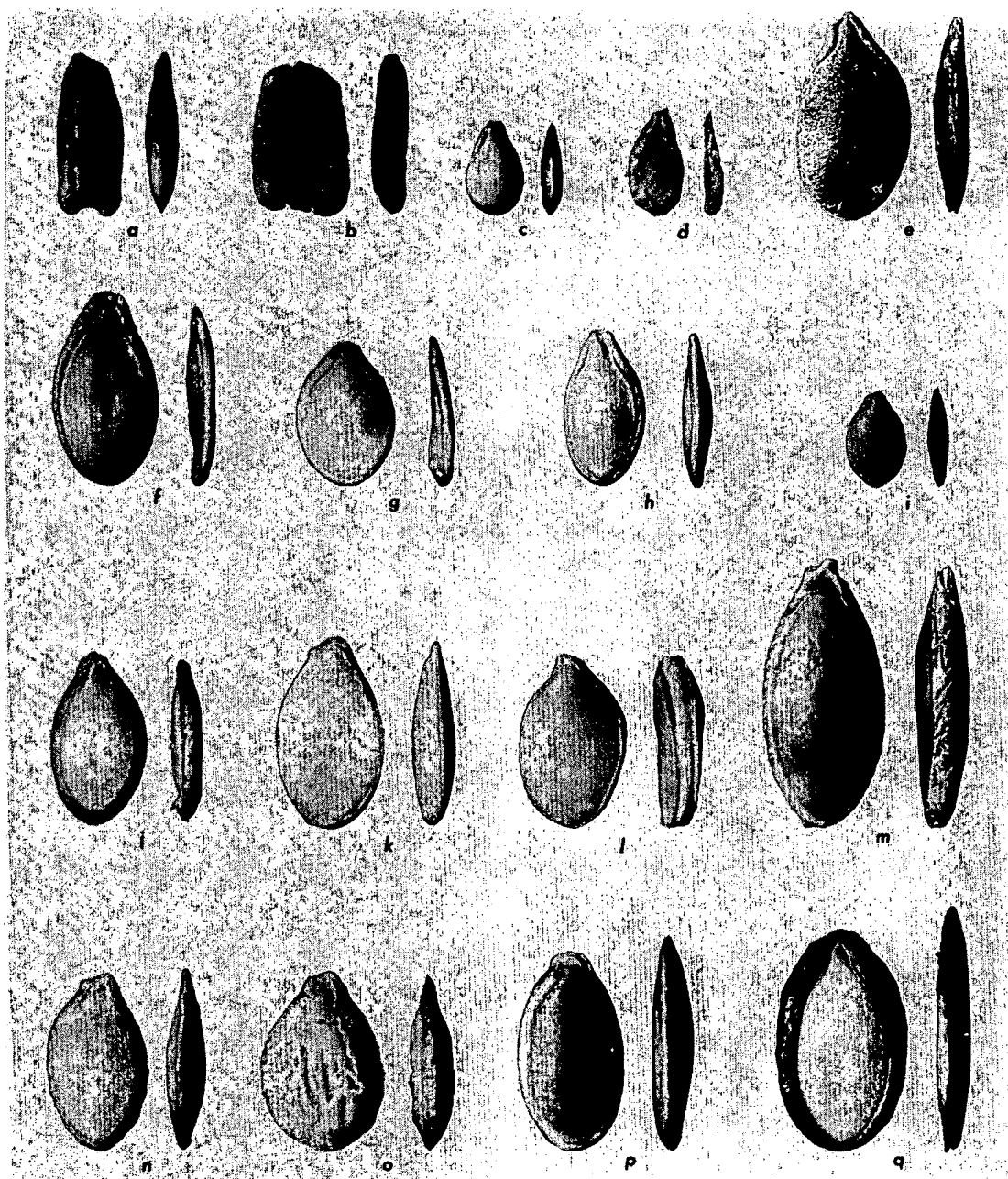


FIG. 3. Seeds of *Lagenaria* and *Cucurbita*, face and edge views, x 1.5. a, *Lagenaria siceraria*, narrow, slender type typical of seeds from Africa and the New World; b, *L. siceraria*, broad, corky, winged type common in Asia; c, *Cucurbita foetidissima*, the most common wild *Cucurbita* of the United States and northern Mexico; d, *C. Lundelliana*, a wild species of *Cucurbita* which can be hybridized with cultivated species; e, *C. ficifolia*, the only perennial species of the cultivated *Cucurbita*; f, *C. pepo* cultivar Connecticut Field, the large pumpkin used for jack-o'-lanterns; g, *C. pepo* cv. Mandan, a small cultivar of the North American Plains; h, *C. pepo* cv. Red Lodge, a medium-sized cultivar from the North American Plains; i, *C. pepo* var. *ovifera*, the small, yellow-flowered gourd, grown in many sizes and shapes as an ornamental; j, *C. moschata* cv. Dickinson's Field Pumpkin, a cultivar commonly grown in Kentucky and to the southeast, and similar to many fruits seen in Mexico; k, *C. maxima* cv. Hubbard, one of the white-seeded group of maximas; l, *C. maxima* cv. Mexican Banana, one of the tan-seeded Banana group; m, an unnamed South American cultivar of *C. maxima* with light brown seeds and pale gold margins; n, *C. mixta* cv. Green Striped Cushaw; o, *C. mixta* cv. Japanese Pie, an extreme of the Green Striped Cushaw group; p, *C. mixta* cv. Taos; q, *C. mixta*, a Mexican cultivar of the silver-seed group.

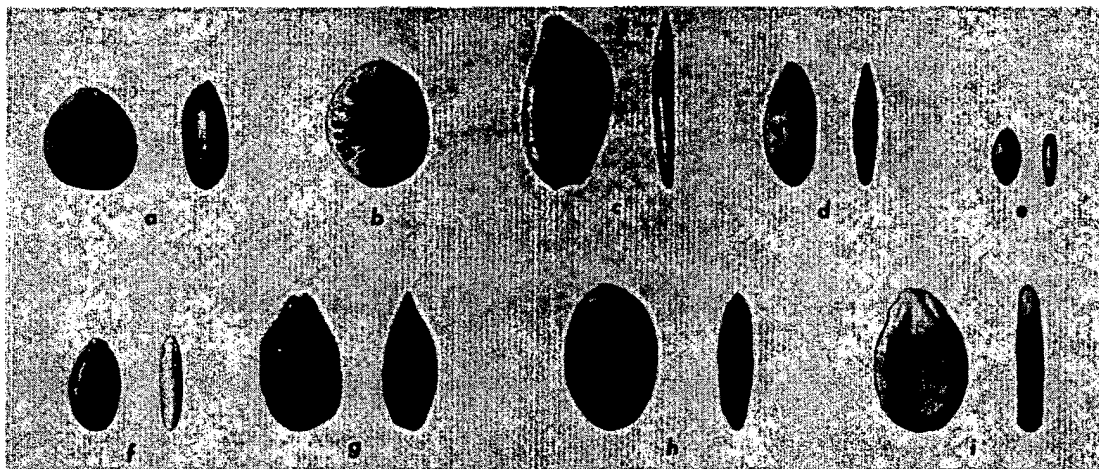


FIG. 4. Seeds of various cucurbits, x 1.5. a, *Apodanthera undulata*, coyote melon; b, *A. undulata*, seed marked by rodent teeth; c, *Sicania odorifera*; d, *Cucumis melo*, muskmelon; e, *C. anguria*, gherkin; f, *Luffa operculata*; g, *Cylindrica*, dishrag gourd or vegetable sponge; h, *L. acutangula*; i, *Citrullus vulgaris*, watermelon.

fragments. The rind characters of *Lagenaria*, *Crescentia* and the cultivated *Cucurbita* are enumerated in detail in Table 4 (Fig. 5).

If the fruits of *Cucurbita* (Figs. 6, 7) were processed in the field for food, it is evident there would be no plant parts preserved in the shelters or other dwelling places. Except for the peduncles this would also be true when the fruits were carried to the dwellings and consumed in the immature state. Where plant remains of *Cucurbita* are found, it is assumed the fruits were transported to the living quarters, and probably stored for a period of time before being eaten. *Lagenaria* is sometimes used for food in the immature state, but the poor quality and low food value of the product suggests this was not a very popular or widespread use. More often the fruits were permitted to mature on the vine, allowed to harden in storage, then made into numerous household and other necessities.

Most of our determinations will probably remain unchanged, but there are many borderline identifications that cannot be considered final, and will doubtless be altered as our techniques become more refined and increase in precision. In the future we should be able to distinguish cultivars and to trace the origin and movement of many kinds of cucurbits with far greater precision than is possible with the relatively crude methods of today.

#### HISTORY OF THE CULTIVATED PUMPKINS AND SQUASHES

*Cucurbita ficifolia* Bouché, the chilicayote of Mexico, is a perennial, like many of the wild

*Cucurbita*. It has large, watermelon-shaped, green and white, or white fruits, and flat, black or dark-brown, and sometimes dingy white seeds (Fig. 3). It is grown in Mexico and the Caribbean as far south as Bolivia, usually in the cool highlands and valleys. The perennial habit, certain characteristics of the fruit stem, the comparative ease with which it will cross with other cultivated species, and its occurrence in the pre-ceramic, premaize, lower levels of Huaca Prieta in north central, coastal Peru (dated at about 3000 B.C., Whitaker and Bird 1949) suggest that it is the oldest of the five cultivated species. Thus far we have identified no other archaeological specimens of *ficifolia* but we have seen relatively few collections of plant materials from the regions in which it grows. *Ficifolia* clearly stands apart from the four annual cultivated species, but has certain similarities to some of the wild species.

The oldest cultivated squash remains we have seen are from the Ocampo Caves (Whitaker, Cutler and MacNeish 1957) and date back to the very beginnings of agriculture in this region (see Table 2). Small *Cucurbita pepo* seeds from the lowest level, the Infiernillo culture (7000–5500 B.C.), may have come from weeds, or camp-follower plants, instead of true cultivated plants, but by the time of the second period, the Ocampo culture (4050 B.C.), *pepo* certainly was cultivated and a considerable number of specimens from this period have been studied. *Pepo* probably originated in northern Mexico because a botanical variety (*C. pepo* var. *ovifera*) of

TABLE 3. DISTINCTIVE CHARACTERISTICS OF PEDUNCLES AND SEEDS OF THE CULTIVATED *Cucurbita*

Species	Peduncle (fruit stem) Characters	Seed Characters
<i>C. pepo</i>	hard; usually with deep furrows; flaring slightly or not at all at base; roughened by coarse setae	light colored; smooth; margin and body same color; variable in size, from 7 mm. to 26 mm.
<i>C. moschata</i>	hard; with fine shallow, smoothly-rounded furrows; widely expanded, and flaring at the base	usually light colored; with a thin, ragged, often wavy or fringed, deeper-colored margin; body often slightly sculptured or pitted
<i>C. mixta</i>	hard; corky and distorted when mature, somewhat <i>moschata</i> -like when young; roughly cylindrical in shape, often with five smooth longitudinal lines running towards thickened ridges on fruit; usually not expanded at base	seeds of three kinds: Green-striped Cushaw group body white, soft, usually split in various patterns, margins rounded and white  Taos group body tan or brown; usually hard, smooth, occasionally split or sculptured; margin threads adhering together or, by wear, separated  Silver-seed group body usually white, somewhat soft; margin greatly enlarged, silvery-green or silvery-blue
<i>C. maxima</i>	soft, spongy-corky; almost cylindrical, usually contracted at base	seeds of three kinds: Hubbard group white, plump; margin white and smooth  Banana Group body dull tan to light brown; smooth to sculptured; plump; margin lighter colored than body  South American group body dull to shiny tan or brown; smooth; margin of gold-like threads usually adhering to each other
<i>C. ficifolia</i>	hard, furrows shallow, smoothly rounded, widely expanded and flaring at base	usually black or dark brown, sometimes dingy-white; relatively broad; margin smooth and rounded

pepo is almost identical with a weedy, wild plant (*C. texana* Gray) found in Texas. Furthermore, the greatest number of pepo cultivars are found in Mexico and the United States with fewer kinds from Guatemala.

Pepo was the only species of *Cucurbita* grown over most of the United States in prehistoric times. Throughout the Southwest it appeared long before *C. moschata*. A large collection of cultivated plant material was recovered by Martin, Rinaldo and their associates from Tularosa Cave in western New Mexico (Martin and others 1952). Although this covers a period of at least 2200 years, there was very little increase in the diversity of pepo. Practically all of the material is from a heavy-peduncled, medium sized pumpkin, although some pepo harvested

quite young, perhaps for use as a green vegetable, may represent another cultivar. To the north, in the region of the Glen Canyon of the Colorado River, remains of thick-shelled pepo specimens used for containers are frequently found (Fig. 7). They are especially abundant in sites which are dated later than A.D. 1100. Relatively few other kinds of pepo are found among the southwestern Indians even today, except for cultivars introduced in post conquest times. The lack of diversity of pepo in the Southwest is particularly striking when one considers the number of cultivars of pepo known from reports, and the abundance of prehistoric specimens from the Plains and the Northeast. As if to compensate for this relative lack of diversity in the pepos of the Southwest, two other cultivated

species entered the area in prehistoric times. Also, there was a far greater use of the wild species but their range extended eastward only

to the southern parts of the plains and prairies, with the exception of the Okeechobee gourd.

*Cucurbita moschata* was the second cultivated species to enter the Southwest. It was grown in northern Peru by 3000 B.C. where it has been excavated, together with *ficifolia* in preceramic, premaize horizons (Whitaker and Bird 1949), and it appeared in the Ocampo Caves (Whitaker, Cutler, and MacNeish 1957) between 1400 and 400 B.C., the period of the Mesa de Guaje culture. This culture was characterized by pottery, figurines, and village life. The people grew corn, jack beans, common beans, and lima beans, and cotton. Although we have few collections on which to base a detailed study of the movements of cultivated plants, it is likely that cotton, lima beans, new kinds of corn, and *moschata* moved into the Southwest about A.D. 700 from Mexico. Our earliest most reliable and abundant records for *moschata* in the Southwest are from Kiet Siel (A.D. 1100-1284) and Montezuma Castle (A.D. 1100-1150) (Table 2). No specimens of *moschata* were found in the large quantities of cultivated plant material excavated at Tularosa Cave, although there was a decided change in the kinds of corn at this site in the San Francisco Phase (A.D. 700) when considerable amounts of cotton appear.

*Moschata* did not become a widespread or common cultivated plant in the Southwest but it may have spread to the Southeast, perhaps along the Gulf, in prehistoric times. The only pre-Columbian *Cucurbita* we have seen from the Southeast is pepo, but good archaeological collections of cultivated plants from that area

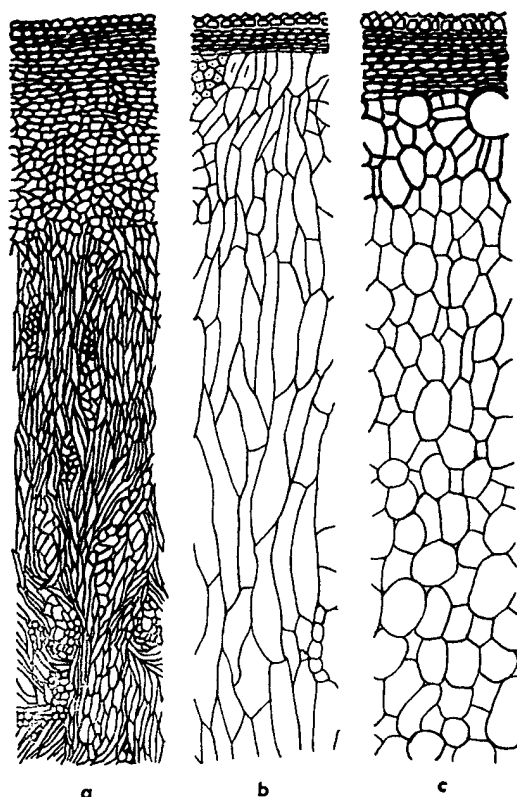


FIG. 5. Typical cross sections of rind or shell of *Crescentia*, *Lagenaria*, and *Cucurbita*, x 150. a, *Crescentia*, tree gourd; b, *Lagenaria*, bottle gourd; c, *Cucurbita*, pumpkin and squash.

TABLE 4. RIND CHARACTERS OF *Crescentia*, *Lagenaria* AND CULTIVATED *Cucurbita*

	<i>Crescentia</i>	<i>Lagenaria</i>	Cultivated <i>Cucurbita</i>
Thickness	less than 1.5 mm.	1-16 mm.	1.5-10 mm., usually less than 4 mm.
Surface Appearance	usually smooth	usually smooth	often slightly furrowed, frequently smooth, especially in <i>C. mixta</i> .
Epidermis (surface cells)	absent	often absent	present
Cells beneath Epidermis	several layers of thick-walled stone cells	small layer of short stone cells followed by small, loose, thin-walled cells	several layers of hard, thick-walled stone cells
Inner Layer of Cells	thick-walled, small, woody cells	large, loosely organized long cells	large, isodiametric thin-walled cells, somewhat regularly arranged

are scarce. The Seminoles in Florida and many of the country people of Louisiana, Alabama, and Mississippi grow *moschata* cultivars, like Dickinson's Field Pumpkin, Cheese, Golden Cushaw, and Kentucky Field Pumpkin, but cultivars similar to these can be collected in Cuba and in coastal and southern Mexico. A recent unpublished study by Cutler and Blake of a series of corn collections from the Southeast

shows that most of the corn grown in this area during prehistoric times was similar to the flint and flour corns of New England. Caribbean tropical flint types appeared in number at the time the Spaniards arrived. It is possible that the Spaniards also brought *moschata* from the Caribbean. In the Plains region the only *moschata* specimens have come from sites which have European material.

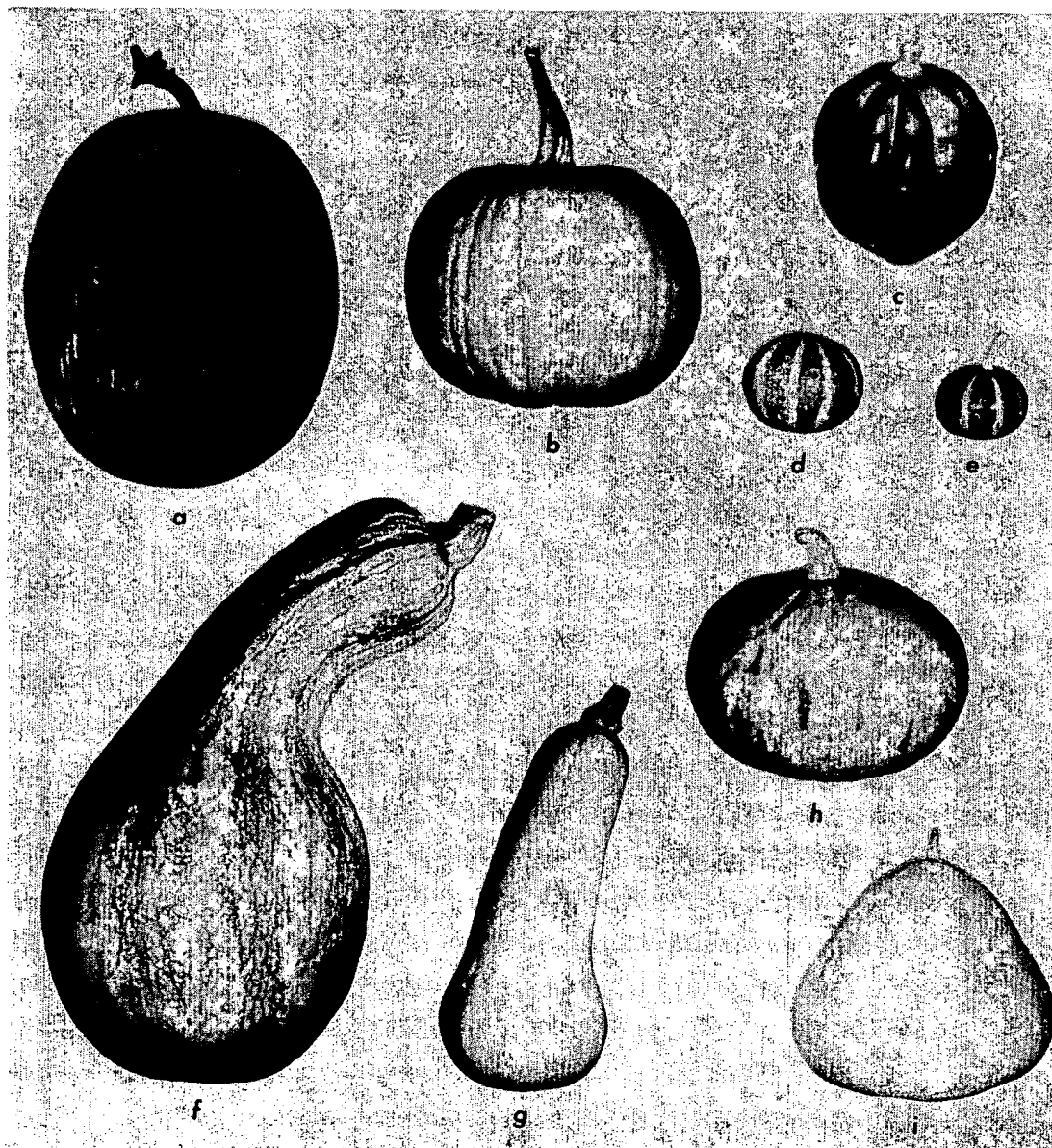


FIG. 6. Fruits of various cucurbits,  $\times \frac{1}{2}$ . a, *Cucurbita ficifolia*, chilicayote; b, *C. pepo* cultivar Field Pumpkin; c, *C. pepo* cv. Acorn Squash; d, e, *C. pepo* var. *ovifera*; f, *C. mixta* cv. Green Striped Cushaw; g, *C. moschata* cv. Butternut; h, *C. maxima* cv. Banquet; i, *Lagenaria siceraria*.

*Cucurbita mixta* Pang. is the youngest and least known of the cultivated annual cucurbits. Although described in 1930 from material collected by the Russian plant expeditions to the New World, a useful English description of mixta did not appear until 1950 (Whitaker and Bohn). Mixta specimens examined before 1950 were usually identified as *C. moschata*. Mixta apparently originated in Mexico where the largest number of kinds are found. The oldest material known is from the Palmillas culture of the Ocampo Caves, Tamaulipas, dated between A.D. 150 and 850. Thus, mixta appeared more than a thousand years later than *moschata* at the same site.

The oldest archaeological specimens of mixta from the Southwest may be from Fremont culture sites of the Glen Canyon of the Colorado River (Cutler MS on Glen Canyon materials excavated by Museum of Northern Arizona). Occasional specimens have been found there associated with cobs of a Mexican pyramidal dent corn practically identical with corn of central and western Mexico. Among the scanty vegetal remains of the Fremont culture sites at Yampa Canyon, there are a few pepo fragments but no mixta. It is likely that larger collections will have mixta, for the species appears occasionally in some Fremont culture and most Pueblo sites farther south, although never as frequently as pepo. Mixta is grown at Taos

Pueblo today, under conditions not greatly different from those of the Fremont culture region. Is it possible that mixta and Mexican pyramidal corn were carried so rapidly to the Fremont culture area that there are few remains along the route? There are some suggestions in the dates of mixta material recovered that this species spread southeastward from the Fremont culture area. In spite of the large amount of anthropological work carried out in the upper Rio Grande River basin, we have little cultivated plant material which can be accurately dated so it has not been possible to establish precise dates for the introduction of mixta to this region. Several kinds of mixta seeds have been described (Cutler and Whitaker 1956). When more collections are available, the distribution of these seed types may help to show their dispersal pattern.

In the Glen Canyon region there are many collections of pepo and mixta from sites dated in the late 1100's and early 1200's. Compared with other areas in the Southwest there is an increase in the amount of hard-shelled pepo and the green-striped cushaw (mixta) used for containers. For the same period there appears to be a decrease in the amount of *Lagenaria*. This occurrence may reflect a climatic change, indicate an increasing emphasis on food plants, or show that pepo and mixta are easier to grow farther north. Pepo and mixta are grown in modern

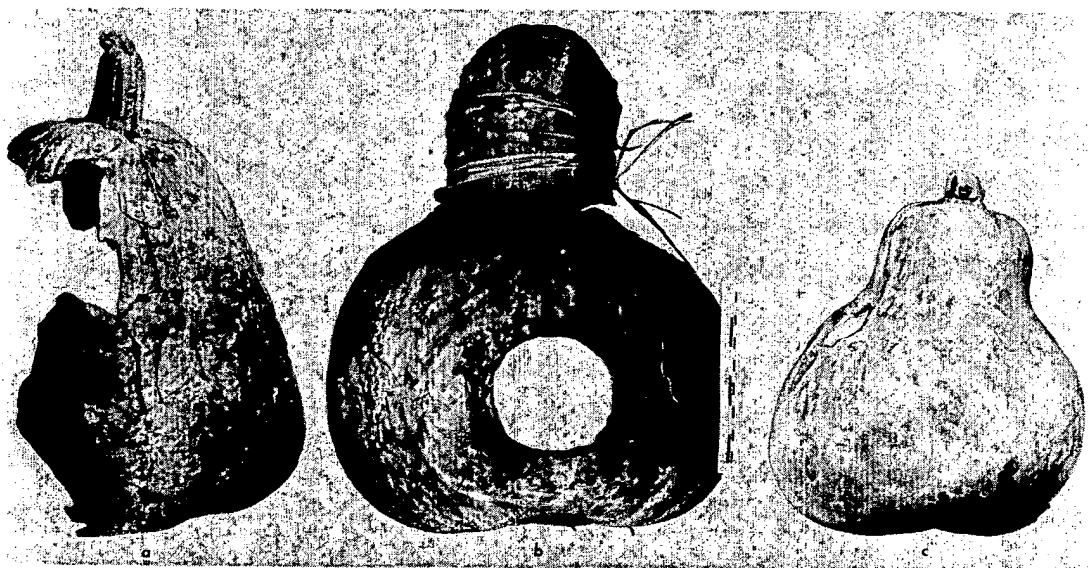


FIG. 7. Containers made of *Cucurbita* fruit from prehistoric sites in the Glen Canyon of the Colorado River, Utah. a, *Cucurbita pepo*, Site 42 Ka 172; b, *C. mixta*, Site 42 Sa 274; c, *C. mixta*, Site 42 Sa 619. Photos by Department of Anthropology, University of Utah.



pueblos, but there is very little *moschata* and *Lagenaria*. In several of the modern pueblos, the flesh is removed from mature fruits of *mixta* through a hole in the side of the upper part. The dried shell that results from this treatment is used as a sounding board for a wooden rasp as well as for a container. Whiting (1939: 93) reports that "the lower portion of the fruit may be cleaned out and the dried shell used by the children to carry parched corn." Both kinds of *mixta* containers, entire shells which have an opening in the side and bowls made from the lower portion of the shell, have been found in several sites in and about Glen Canyon (Fig. 7).

*Cucurbita maxima* was cultivated only in South America in prehistoric times. *Ficifolia* and *moschata* were the only species of *Cucurbita* to be excavated at Huaca Prieta in north coastal Peru but *maxima* has been found in several sites to the south (Carter 1945). The largest number of cultivars of this species are grown in the high valleys of southern Peru, Bolivia, and Chile. At lower altitudes in eastern Bolivia, Argentina, and Brazil a number of hybrids of *maxima* with weedy *C. andreana* are grown.

A squash similar to the well-known Hubbard probably was introduced in New England in the late 1700's and other *maximas* were grown in eastern states in the early 1800's (Tapley, Enzie, and Van Eseltine 1937). By the late 1800's similar kinds were grown by the Arikara and other Plains Indians and varieties of *maxima* are grown today by the Pueblo and other Indian groups. They are often called "white man's squash" or some other name suggesting their recent introduction. Whiting (1939), for example, lists a Hopi name for the turban squash, a *maxima*, which means Mormon squash.

#### HISTORY AND USES OF THE BOTTLE GOURD

There is only one species of this genus, *Lagenaria siceraria*, but it is grown in so many places and has so many sizes and shapes of fruit that there are numerous scientific and common names for this species. Obsolete scientific names most frequently encountered are: *Cucurbita lagenaria* L., *Cucurbita leucantha* Duch., *Lagenaria vulgaris* Ser. The terms calabash and gourd, while often applied to other fruits used for containers, usually refer to *Lagenaria*. A useful common name is "bottle gourd" for while many fruits are large and durable enough for rattles, snuff boxes, small musical instruments, only *Lagenaria* fruits are large enough and can be

shaped to make the common water jugs used in so many parts of the world. The generic name has occasionally been used as a common name and is certainly the most precise one.

*Lagenaria* is easily distinguished from all species of *Cucurbita* by its white flowers, seed and leaf shape, and by the structure of the fruit rind (Fig. 5). It is a very distinctive species and clearly has no close affinities with any existing species of *Cucurbita*. Its relationship, however, to other genera in the family Cucurbitaceae is not well understood. There is no decisive evidence relative to the origin of this species, but it is probably indigenous to tropical Africa. This suggestion is based upon the greater variability of seeds and fruits of collections from Africa as compared to the few specimens from Asia and the collections from archaeological sites and living peoples in the Americas. Burkill (1935), an authority on the cultivated plants of Asia, has suggested that *Lagenaria* is indigenous to Africa and was domesticated in Asia. Schweinfurth (1884) has identified a rind fragment from an Egyptian tomb of the 5th Dynasty, dated about 3500-3300 B.C. The earliest record of *L. siceraria* in this hemisphere is from the Ocampo Caves, Tamaulipas, Mexico (Whitaker, Cutler, and MacNeish 1957). At this site, rind fragments were found in abundance in strata dated at 7000-5500 B.C.

Vavilov (1931) suggested that "the bottle gourd evidently has been carried to the coasts of the New World by oceanic currents or in some other way, and has been introduced into cultivation by the farmer of pre-Columbian times." Reasoning from some experiments in which they floated gourds in sea water for as long as one year, Whitaker and Carter (1954) suggest that the gourds could have floated across the Atlantic from Africa to South America with the seeds retaining a high degree of viability. If floating offers a reasonable method of transport, it is no longer necessary to invoke trans-Atlantic or trans-Pacific migration by man to explain the bi-hemispheric distribution of this species.

*Lagenaria* has been found in almost every archaeological site in the Americas wherever conditions were favorable for its cultivation, and vegetal materials were preserved. Rind fragments are usually abundant at most sites, and in many instances intact fruits have been recovered, along with a few seeds and peduncles. The scarcity of seeds of *Lagenaria* in archaeological deposits may be explained by their use

for food. Some of the Indian groups which grew *Lagenaria* recently are reported to have roasted and eaten the seeds just as they did the seeds of various species of *Cucurbita*. Apparently immature forms of *Lagenaria* were not eaten in the New World as they were in the Old World for there are few records of such use from living Indians and no specimens of the very large, thin-shelled forms of *Lagenaria* which were selected for food use. The use of young *Lagenaria* for food in Brazil (where it is called *abobra d'agua*, or water squash) appears to have come from Africa and is restricted to areas where the African *Momordica charantia*, the balsam pear, is common and many Negroes live.

Shells of the mature fruits were employed for all conceivable purposes around the household. For people lacking techniques of manufacturing cutlery and pottery, utensils made from *Lagenaria* shells were indispensable. Even in later cultures where pottery making was well established, *Lagenaria* continued to be used for water jugs, work baskets, and containers of various sorts. In some of the more advanced cultures, the people used the fruit shells for rattles in religious rituals and for face masks in ceremonial dances. *Lagenaria* was also used for dippers, spoons, pottery scrapers, cups, scoops, ladles, fish-net floats, medicine bottles, coca carriers, whistles, and many other things. Gourds patched with cords laced through drilled holes and treated with resin have been excavated at many sites. The care given these vessels is a good indicator of their value to the people using them.

#### ARCHAEOLOGY OF THE CUCURBITS IN THE AMERICAS

In Table 2 we have arranged the archaeological sites from which cucurbit material has been recovered according to their chronology. A number of sites frequently mentioned in the literature have been omitted for lack of definite identification of the cucurbit specimens, and because the material was not readily available for checking. It is evident from the data in Table 2 that pepo was present in the Woodlands from at least A.D. 1100 to the time of contact with the Europeans. The non-cultivated *Cucurbita foetidissima* and *Lagenaria siceraria* were also used. In the Plains area pepo is present earliest in the sites dated at about A.D. 1400. Moschata comes in after 1700; some non-cultivated species of

*Cucurbita* was used, probably *C. foetidissima*. The modern Plains Indians had pepo, mixta, moschata, and maxima. In Southern Colorado, pepo is found as early as A.D. 174 at the Falls Creek site. *Lagenaria* is recorded from Step House at A.D. 610, and there are a few mixta specimens from Mesa Verde.

The rich collections from Arizona give a continuous and mostly overlapping record of cucurbits from A.D. 380 to 1346. Pepo and *Lagenaria* are found throughout the entire chronology. Moschata and mixta came into Arizona at about the same time (A.D. 900). There is abundant evidence that a non-cultivated species of *Cucurbita*, probably *C. foetidissima*, was extensively used.

The earliest record of cucurbits from the Southwest comes from the Cordova and Tularosa caves of New Mexico. Pepo and *Lagenaria* are recorded from these sites as early as 300 B.C. Mixta and moschata come in at A.D. 900 in the Pueblo II Rockshelters of Clark County, New Mexico. Mixta is recorded from several sites but this is the only occurrence of moschata. Seeds and rinds of *Cucurbita foetidissima* are also recorded from some sites in the area. The modern pueblos of San Ildefonso, Tesuque, and Taos had pepo, mixta, and maxima. In the Sunny Glen Cave of the Chisos Mountains of Texas, dated at A.D. 1300, pepo seeds were found.

The earliest recorded occurrence of the cultivated cucurbits is from Mexico. From the Ocampo Caves in Tamaulipas, pepo, *C. foetidissima*, and *Lagenaria* were recovered in strata dated at 7000 B.C. Moschata is recorded at 1850 B.C., with mixta coming in at A.D. 150. Pepo, mixta, and *Lagenaria* are found in Cave Valley, Chihuahua at about A.D. 900 and pepo in Durango at A.D. 1200.

In South America, *ficifolia*, moschata, and *Lagenaria* are reported from the huge midden at Huaca Prieta, Peru, in strata dated at about 3000 B.C. Maxima seeds were found at three locations in Peru, the oldest with a date of A.D. 600. A single peduncle of moschata has been identified from a Mayan ruin in Guatemala (Vestal 1938). The evidence suggests a date of about A.D. 900 for this material.

#### OTHER NEW WORLD CUCURBITS

Other cucurbits have been recovered from archaeological sites in the New World, while some occur as weeds in the tropics, or are wide-



ly cultivated. *Apodanthera undulata* Gray, the melon-loco, has soft fruits somewhat smaller than those of *Cucurbita foetidissima* and other wild *Cucurbita* species. It grows in weedy areas of the Southwest, and seeds have been found in several pre-Columbian sites. Although the seeds are reported to have been used for food by historic Indians, the possibility that they were introduced into sites by weeds growing nearby, or even over the site, after abandonment, or by rodents, should not be dismissed. From several sites we have seen seeds of *Apodanthera* which were clearly scratched by the paired teeth of rodents (Fig. 4).

*Luffa operculata* (L.) Cogn. is the only New World native of this genus. It is used widely in folk medicine (the seeds are a violent purgative) and has been collected from Mexico to Brazil and Bolivia, so it may be a true native. Margaret Towle, who has studied the major collections of plant materials from archaeological sites in Peru, reports in correspondence that she has not seen any in the Viru Valley material excavated by W. D. Strong or the Huaca Prieta material dug by J. B. Bird. It is unfortunate that the cultivated plants and related weeds of the New World have not been studied more thoroughly. The most complete reports are those of the several Russian expeditions directed by Vavilov and published in Russian from about 1927 to 1938.

*Cyclanthera pedata* Schrad. (called caiba, pepino, and a number of other names in tropical America) and several other species of this squirting cucumber-like plant are widely grown and undoubtedly native or cultivated since pre-Columbian times from Mexico to Chile. The fruit is so soft that it is unlikely any will be found in archaeological sites but the rough dark seeds would be readily recognized if found.

*Sechium edule* Sw. is the chayote of Mexico, and the xu-xu of Brazil. In its center of diversity in southern Mexico and the highlands of Guatemala there are numerous forms, from dark to light, fibrous to tender, small to large, and spiny to smooth. The plant is grown as a perennial and the large storage roots are frequently eaten. Since the bland fruit and the single large seed are soft, they have not been found in archaeological sites. They are, however, common in fields and markets in many parts of the Americas.

*Sicania odorifera* Naud. has maroon or purplish, sweet fruits, with a nut-like odor. The fruit is eaten raw or made into candy. Although it may be found from Mexico to Bolivia and Brazil, and apparently is an indigenous, cultivated plant of the Americas, we have seen no archaeological specimens.

#### OLD WORLD CUCURBITS OFTEN GROWN IN THE NEW WORLD IN POST-EUROPEAN TIMES

*Citrullis vulgaris* Schrad., the watermelon or sandia, is widely grown in the New World and was introduced so soon after Europeans arrived that it has been considered a native by authors who knew little of its distribution and relationships. There is every reason to believe it is an Old World plant. There is no valid evidence to indicate it was present in the New World in pre-Columbian times. Watermelon seeds have never been found in a New World site unless other evidences of European contacts were present.

Muskmelons (*Cucumis melo* L.) are grown by many Indians in the Americas but they are introductions, like the cucumber (*Cucumis sativus* L.) from the Old World. For many years botanists speculated about the origin of the gherkin (*Cucumis anguria* L.), which is widely cultivated and found as a weed in Brazil and the Caribbean region. It is called maxixe in Brazil. Recent studies indicate that the gherkin was introduced from Africa, probably by the slave trade.

Another African cucurbit, the balsam pear (*Momordica charantia*), grows as a weed, often with *Cucumis anguria*, and usually in places where slaves formerly lived. In the case of the balsam pear, however, there never has been any doubt that the plant came from Africa for it is only used by Negroes and rarely grows far from their homes.

*Acknowledgments.* We are indebted to the officials of the John Simon Guggenheim Memorial Foundation, the National Science Foundation, and the Wenner-Gren Foundation for Anthropological Research for generous financial aid which made this and related studies possible. The following individuals have made our task and the results more significant by their helpful advice, comments, suggestions and criticism: Edgar Anderson, Emil Haury, Volney Jones, Paul Martin, and Waldo Wedel.

BAILEY, L. H.

1943 Species of *Cucurbita*. *Genes Herbarum*, Vol. 4, Art. 6, pp. 267-316. Ithaca.

1948 Jottings in the Cucurbits. *Genes Herbarum*, Vol. 7, Art. 6, pp. 449-77. Ithaca.

- BURKILL, I. H.  
1935 *A Dictionary of the Economic Products of the Malay Peninsula*, two volumes. Crown Agents for the Colonies, London.
- CARTER, G. F.  
1945 Some Archeologic Cucurbit Seed from Peru. *Acta Americana*, Vol. 3, No. 3, pp. 163-72.
- CUTLER, H. C. AND T. W. WHITAKER  
1956 *Cucurbita mixta* Pang.: Its Classification and Relationships. *Bulletin of the Torrey Botanical Club*, Vol. 83, No. 4, pp. 253-60. New York.
- MARTIN, P. S., J. B. RINALDO, ELAINE BLUHM, H. C. CUTLER, AND ROGER GRANGE, JR.  
1952 Mogollon Cultural Continuity and Change. *Fieldiana: Anthropology*, Vol. 40. Chicago Natural History Museum, Chicago.
- SCHWEINFURTH, GEORGE  
1884 Neue Funde auf dem Gebiete der Flora des alten Ägyptens. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie*, Vol. 5, pp. 189-202. Leipzig.
- TAPLEY, W. T., W. D. ENZIE, AND G. P. VAN ESELTINE  
1937 The Vegetables of New York, Part IV: The Cucurbits. *Report of the New York State Agricultural Experiment Station for 1935*. Albany.
- VAVILOV, N. I.  
1931 Mexico and Central America as the Principal Centers of Cultivated Plants of the New World. *Bulletin of Applied Botany and Plant Breeding*, Vol. 26, pp. 139-248. Lenin Academy of Agricultural Sciences in U.S.S.R., Institute of Plant Industry, Leningrad.
- VESTAL, P. A.  
1938 *Cucurbita moschata* Found in Pre-Columbian Mounds in Guatemala. *Harvard University Botanical Leaflets*, Vol. 6, No. 4, pp. 65-9. Cambridge.
- WHITAKER, T. W. AND J. B. BIRD  
1949 Identification and Significance of the Cucurbit Materials from Huaca Prieta, Peru. *American Museum Novitates*, No. 1426, pp. 1-15. American Museum of Natural History, New York.
- WHITAKER, T. W. AND G. W. BOHN  
1950 The Taxonomy, Genetics, Production, and Uses of the Cultivated Species of *Cucurbita*. *Economic Botany*, Vol. 4, No. 1, pp. 52-81. Baltimore.
- WHITAKER, T. W. AND G. F. CARTER  
1954 Oceanic Drift of Gourds: Experimental Observations. *American Journal of Botany*, Vol. 41, No. 9, pp. 697-700. Baltimore.
- WHITAKER, T. W., H. C. CUTLER, AND R. S. MACNEISH  
1957 Cucurbit Materials from Three Caves near Ocampo, Tamaulipas. *American Antiquity*, Vol. 22, No. 4, pp. 352-8. Salt Lake City.
- WHITING, A. F.  
1939 Ethnobotany of the Hopi. *Museum of Northern Arizona, Bulletin*, No. 15. Flagstaff.
- MISSOURI BOTANICAL GARDEN AND  
WASHINGTON UNIVERSITY  
St. Louis, Mo.  
UNITED STATES DEPARTMENT OF AGRICULTURE  
La Jolla, Calif.  
November, 1960